

REMARKS

Applicants respectfully request reconsideration of the present application in view of the foregoing amendments and in view of the reasons that follow.

Status of Claims:

Claims 1, 7 and 11 are currently being amended.

No claims are currently being canceled.

Claims 17-20 are currently being added. Support for new claims 17 and 18 may be found in Figures 2 and 3, as well as page 19 of the specification (for claim 17) and page 24 of the specification (for claim 18), and on page 26 of the specification and Figure 5 (for claim 19), as well as on pages 37 and 38 of the specification and Figure 8 (for claim 20).

This amendment and reply amends and adds claims in this application. A detailed listing of all claims that are, or were, in the application, irrespective of whether the claims remain under examination in the application, is presented, with an appropriate defined status identifier.

After amending and adding the claims as set forth above, claims 1-20 are now pending in this application.

Claim Rejections – 35 U.S.C. § 112, 1st Paragraph:

In the Office Action, claim 11 was rejected under 35 U.S.C. § 112, 1st paragraph, as failing to comply with the written description requirement, for the reasons set forth on pages 3 and 4 of the Office Action. This rejection is respectfully traversed for the reasons given below.

Support for the features recited in claim 11 may be found in Figure 6, steps ST3, ST4, ST5 and ST6, whereby step ST3 describes that a bare board is delivered, step ST4 describes that an image is picked up, step ST5 describes that a command is input, and step ST6 describes that an inspection window is corrected.

In the interest of expediting prosecution, claim 11 has been amended to explicitly recite features described above in Figure 6.

Accordingly, claim 11 has full written description support in the specification, and thus that claim fully complies with 35 U.S.C. § 112, 1st paragraph.

Claim Rejections – Prior Art:

In the Office Action, claims 1-8, 10, 11 and 13-16 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,278,797 to Nagasaki et al.; and claims 9 and 12 were rejected under 35 U.S.C. § 103(a) as unpatentable over Nagasaki et al. These rejections are traversed for at least the reasons given below.

The present invention is directed to providing a board inspection apparatus or method which is capable of automatically correcting/adjusting the settings of inspection windows when the position or size of lands on the inspection target board has been changed due to changes in design rules for designing the board, so that an inspection window is appropriately adapted for inspection of a board.

According to the present invention, the set data for setting the inspection windows is automatically corrected by using an image taken from a model board for a board to be inspected. More specifically, inspection windows, which are included in inspection data pre-registered in a parts library (produced using an image of a board designed based on a prescribed, predetermined design rule), are read out from a parts library and assigned to an inspection target board. Then, when a design rule has been changed and the read inspection windows fail to correspond to size or position of the lands on the board, the read inspection windows are automatically corrected based on the image area of the lands on the model board. That way, the inspection windows, after adjustment, appropriately correspond to the parts on the target board. Such automatic correction of the set data for the inspection windows greatly contributes to time savings and labor savings in a board inspection process or system.

Turning now to the cited art of record, Nagasaki et al. is directed to an apparatus for inspecting a land-attached circuit board. Nagasaki et al. discloses that the inspection apparatus is capable of detecting the information on a land existing region, and the size, area, and formed position of the land. Nagasaki's inspection apparatus is capable of inspecting height levels of the lands by two-dimensional scanning of an inspection beam, as described in the Abstract and column 12, lines 10-15 of Nagasaki et al. However, Nagasaki et al. does not disclose or suggest the above-mentioned features of the present invention as discussed above, and Nagasaki et al. does not disclose or suggest the correcting of inspection windows so as to appropriately correspond to the parts on a board to be inspected.

With respect to the features of correcting inspection windows in independent claim 1, the Office Action cites column 6, lines 50-57, column 3, lines 55-61, column 7, lines 1-12, column 4, lines 4-41, column 21, lines 4-25 and Figures 12A and 12B of Nagasaki et al. Applicants respectfully disagree.

Namely, column 6, lines 50-55 of Nagasaki et al. describes position tolerance defining window setting means for setting tolerance defining windows for defining a tolerance of a position where each land is formed. However, the tolerance of a land does not correspond to a changing of a design rule, but rather it corresponds to allowances to be made for formation of a land during a normal manufacturing process of a land. Column 3, lines 55-61 of Nagasaki et al. describes that land size information is prepared to reflect an area and/or other dimension of each land on the basis of an area and/or other dimensions of corresponding land existing regions. Column 7, lines 1-12 of Nagasaki et al. describes that an inspection beam is provided onto an inspection surface while a circuit board is held in place, whereby height level calculating means calculates a height level of each land above a reference height level. Column 4, lines 4-41 of Nagasaki et al. describes characteristics of a land center calculating means that calculates a point of intersection of diagonal lines of a quadrilateral region that circumscribes land existing regions, whereby each land existing region is fixed by means of an image which has pixels disposed on a pixel plane. Column 21, lines 4-25 of Nagasaki et al. describes that a correction data group storing section stores a deviated amount based on an inclination angle of each surface of a polygon mirror, in order to obtain corrected coordinate values and height levels of the lands, and is not at all concerned with correcting any inspection windows. Figures 12A and 12B of Nagasaki et al. show the content of a receive data storing RA and the content of a corrected data memory section, whereby that data includes height data, brightness data, and positional data.

Please note that independent claims 1 and 7 that the inspection window is adapted due to a design rule change for one or more of the parts mounted on the board, whereby such features are not disclosed, taught or suggested by Nagasaki et al. Put in another way, no updating of information in a parts library is performed in the system of Nagasaki et al., based on a design rule change that has been used to construct a board to be inspected.

Accordingly, presently pending independent claims 1 and 7 are not anticipated by Nagasaki et al.

Still further, with respect to dependent claims 11-14, the Office Action asserts that column 4, lines 21-41 and column 23, lines 43-67 of Nagasaki et al. discloses or suggests these features, but Applicants respectfully disagree. Namely, claims 11 and 12 recite that the inspection window is corrected using the image picked up from the model of the board on which no parts have been mounted. Column 4, lines 21-41 of Nagasaki et al. describes that an image of each land existing region and a master image are formed by a combination of pixels in output states, whereby those images are matched with high accuracy, so as to fix the position of the land existing regions. There is no disclosure or suggestion in this portion of Nagasaki et al. that the master image corresponds to a model of a board on which no parts have been mounted. Column 23, lines 43-67 of Nagasaki et al. describes that an image obtained from pixel data can be used as an image indicating a land existing region and a master image, whereby a standard picked-up image can be used as a master image. Clearly, the master image described in this portion of Nagasaki et al. cannot correspond to a model of a board on which no parts have been mounted. Column 4, lines 42-60 and column 14, line 60 of Nagasaki et al. does not provide any evidence that the master image of Nagasaki corresponds to a bare board. Note column 4, lines 24-26 of Nagasaki et al., which states that “a master image corresponding in shape to each of the land existing regions and reflecting an area and/or other dimension of each of the land existing regions is prepared . . .” This seems to imply that the master image does include (reference) parts mounted on a part.

Accordingly, dependent claims 11 and 12, as well as claims 13 and 14 which recite similar features (albeit in a slightly different way than how they are recited in claims 11 and 12) are patentable for these additional reasons, beyond the reasons given above for their respective base claim.

New Claims:

New claims 17-20 have been added to recite additional features of the present invention that are believed to provide an additional basis of patentability for those claims, beyond the reasons given above for their respective base claim.

Conclusion:

Since all of the issues raised in the Office Action have been addressed in this Amendment and Reply, Applicants believe that the present application is now in condition for allowance, and an early indication of allowance is respectfully requested.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check or credit card payment form being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741. If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicant hereby petitions for such extension under 37 C.F.R. §1.136 and authorizes payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

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